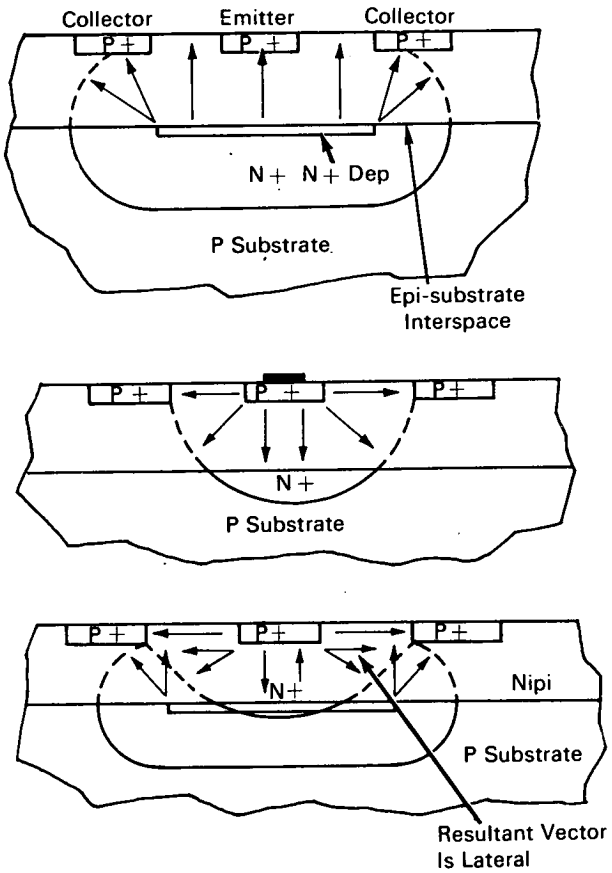
NASA TECH BRIEF

Lateral PNP Bipolar Transistor with Aiding Field Diffusions



Lateral PNP Bipolar Transistor Fields

A technique for obtaining field aided lateral PNP transistors is described. This device is compatible with micropower switching circuits requiring P-N junction capacitors on the monolithic chip and complementary transistors.

The sub-collector diffusion is performed with phosphorus as the dopant and the epitaxy is grown using the higher temperature $SiCl_4$ process. Higher temperature coupled with the larger diffusion constant associated with phosphorus causes the N+sub-collector to diffuse to the surface. Placement of the sub-collector results in the following:

1. Decrease in BV_{CBO}
2. Increase in C_{BC}
3. Decrease in parasitic PNP beta to substrate
4. Built-in-field toward the surface.

The BV_{CBO} decrease is not harmful to micropower IC's requiring BV_{CEO} of 10 volts. Increase in C_{BC} allows larger value capacitors to be included in the circuit to by-pass base bias resistors. Decrease in the parasitic PNP beta leads to a lateral PNP transistor current gain. The surface oriented built-in-field bends the injected minority in the base region towards the surface collector.

Since the desired PNP transistor action is lateral, a built-in-field in the lateral direction is also desirable. The phosphorous diffusion can be a surface diffusion proceeding laterally to the collector. This low C_O phosphorous diffusion is placed under the lateral PNP transistor emitter in the future contact area of the emitter. At this point the built-in-field is laterally and substrate oriented. The parasitic PNP to the substrate is reduced by the sub-collector diffusion with a surface oriented field and a low lifetime base region. The built-in-field increases transit time of the minority carrier in the base region and improves the poor frequency cutoff of the lateral structure.

Note:

No additional documentation is available.

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

Source: R. C. Gallagher and D. H. McCann of
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